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PATENTS

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In re application of

Peter Antonio NAVARRO Y KOREN et al. Conf. No. 3493

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Title: MATRIX-FORMING COMPOSITION CONTAINING PECTIN

RULE 132 DECLARATION OF K.M.J. VAN LAERE

The undersigned, Dr K.M.J. van Laere, the Netherlands, herewith declares as follows:

1. I have been an employee of N.V. Nutricia, at Zoetermeer, the Netherlands, the assignee of the present invention, for over 6 years. I am a graduate of biosciences with a specialization in food science, obtained a Ph.D. at Wageningen University in The Netherlands#. For about 6 years I have been involved in food research, particularly the physiological effects of dietary fibers and indigestible oligosaccharides.

   # Laere, KJM, Degradation of structurally different non-digestible oligosaccharides by intestinal bacteria: glycosylhydrolases of Bi. adolescentis. PhD-thesis, Wageningen Agricultural University, Wageningen, The Netherlands

2. In order to assess the effect of indigestible oligosaccharides on calcium availability in the intestines I have conducted the following experiment.

3. A so called MacFarlane medium was prepared from the following ingredients:

Buffered peptone water	3,0	g/l
Yeast Extract	2,5	g/l
Tryptone	3,0	g/l
L-Cysteine-HCl	0,4	g/l
Bile salts	0,05	g/l
$K_2HPO_4.3H2O$	2,6	g/l
$NaHCO_3$	0,2	g/l
NaCl	4,5	g/l
$MgSO_4.7H_2O$	0,5	g/l
$CaCl_2$	0,228	g/l
$FeSO_4.7H_2O$	0,005	g/l

pH was adjusted to 6.3±0.1 using 2M HCl and subsequently the medium was sterilized.

3. Subsequently, a fecal suspension was prepared under anaerobic conditions by suspending human feces in the McFarlane medium in a weight ratio feces: MacFarlane medium of 1:5. The suspension was subsequently sieved to remove solid components.

15 ml of the fecal suspension was mixed with a dry mixture consisting of either pectin and calcium; or pectin, calcium and oligosaccharide (see Tabel A) and incubated for 24 hours at 37°C under anaerobic conditions.

After incubation, the solids were removed from the suspension by centrifugation and pH and free calcium concentration were determined with a calcium electrode (model 720A, ThermoOrion, Beverly, USA). The results so obtained are presented in Table A.

TABLE A

Sample No	LM Pectin*** (mg)	$CaPO_4$ (mg)	Oligosaccharide	pH	Free calcium (ppm)
1	100	100	500 mg Fibersol®*	4.6	200
2	100	100	-	5.5	107
3	200	100	320 mg Fibersol®*	4.6	180
~~4~~	~~200~~	~~100~~		~~5.3~~	~~144~~
5	50	100	250 mg Fructo-Oligosaccharides**	3.9	362
6	50	100	-	5.7	86

* Fibersol-2® (Matsutani)
** Raftilose™ (Orafti Active Food Ingredients)
*** Genu-pectin LM-104 AS (Orffa-Hercules)

4. Fibersol-2® is an indigestible oligosaccharide that is produced by a combination of heat and enzymatic treatment of corn starch. Raftilose ™ is an indigestible fructo-oligosaccharide that is produced from inulin by partial hydrolysis using endo-inulase. The attached excerpts taken from "Advanced Dietary Fibre Technology", Blackwell Science Ltd. (2001), pages 480-484 and 509-511 assert that Fibersol-2® and short chain fructo-oligosaccharides are indigestible and provide additional information about the chemical identity of these indigestible oligosaccharides.

5. The above experimental results indicate that indigestible oligosaccharides are capable of substantially increasing free calcium availability in the presence of pectin. In my view, these results warrant the conclusion that indigestible oligosaccharides can be used to increase bioavailability of calcium from ingested compositions that contain calcium and pectin and/or alginate.

6. I further declare that all statements made herein are true and that all statements made on information and belief are believed to be true; and further that that these statements are made with

the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements and the like so made jeopardize the validity of the document, or application, or any patent issuing thereon

Signed this 1st day of October 2004

By

Dr K.M.J. van Laere

Enclosure: Advanced Dietary Fibre Technology, Blackwell Science Ltd. (2001), pages 480-484 and 509-511

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44 Fibersol-2: a Soluble, Non-digestible, Starch-derived Dietary Fibre

Kazuhiro Ohkuma and Shigeru Wakabayashi

44.1 Introduction

Starch has been widely consumed by humans as an inexpensive and stable source of available carbohydrate. Starch, in the native form, starch hydrolysates or modified starches have been utilised in various ways due to its excellent digestibility.

In recent years, indigestible species or components have been found in starches, and these starches are called 'resistant starches' (Englyst & Cummings 1987). Resistant starches have been widely studied and shown to have physiological functions similar to those of dietary fibres.

Similarly, we have found the same types of indigestible components in starch hydrolysates, such as dextrin, maltodextrin and corn syrup. Starch hydrolysates containing the indigestible components are termed 'resistant maltodextrins'. One such material, which is produced by a combination of hydrolysis and transglucosidation reactions (that occur during hydrolysis), has physiological attributes resembling those of dietary fibre. The physical characteristics of this material make it suitable for use in various food applications.

In this chapter we will describe the properties of one of these resistant maltodextrin materials, namely Fibersol-2®.

44.2 Production method and basic characteristics of Fibersol-2

Fibersol-2 is produced by a combination of heat and enzymatic treatment of cornstarch, as detailed in US Patent Nos. 5620873 and 5358729. In the first reaction, cornstarch is heated with a small amount of hydrochloric acid under low-moisture conditions. During this reaction, the cornstarch is hydrolysed by transglucosidation. In the second reaction, the above-obtained solution is hydrolysed by an amylase. The material is then refined to separate out impurities, analysed to ensure that the dextrose equivalent (DE) is below 20, and is then powdered by spray-drying. In Japan, this material is of the type known as an indigestible dextrin, and simultaneously meets the US GRAS (generally recognised as safe) requirements as set forth in 21 CFR 184-1444 (Maltodextrin).

An average molecular weight of Fibersol-2 is 2000 Da, and the proposed structural composition is shown in Fig. 44.1. Fibersol-2 is composed not only of $\alpha(1\rightarrow4)$ and $\alpha(1\rightarrow6)$ glucosidic bonds, as are present in the native starch, but also contains $1\rightarrow2$ and $1\rightarrow3$ linkages and levoglucosan. Due to these structural characteristics, Fibersol-2 contains well-developed, branched particles that are partially hydrolysed by human digestive enzymes.

The product specifications of Fibersol-2, and the analytical methods used to measure this material, are shown in Table 44.1. Fibersol-2 is a white powder and contains about 90% of

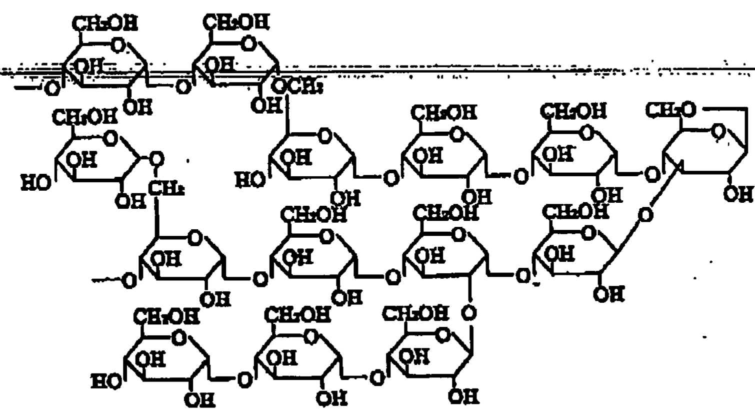

Fig. 44.1 Estimated structural formula of Fibersol-2.

Table 44.1 Product specifications of Fibersol-2.

Property	Specification	Test method
Appearance	White, free-flowing powder	Sensory test
Taste/odour	Slightly sweet/odourless	Sensory test
Solution	Clear	Sensory test
Moisture	5% maximum	JAS method
Total dietary fibre	85% minimum	Enzyme-HPLC method
Dextrose equivalent	8.0–12.0	WS method
pH	4–6 in 10% solution	pH meter
Ash	0.2% maximum	Japanese Standards for Food Additives
Arsenic	1 p.p.m. maximum	
Heavy metals	5 p.p.m. maximum	
Microbiological		
Standard plate count	300/gram, maximum	Japanese Food Sanitation Law
Yeast and mould	100/gram, maximum	
Salmonella	Negative/25 g	
Coliforms	Negative/g	

indigestible components (as we claim to be dietary fibre). The enzyme-high-performance liquid chromatography (HPLC) method (Table 44.1) has been validated by the Japanese Government as an official analytical method for determining total dietary fibre, including low-molecular weight soluble dietary fibre (Ohkuma *et al.* 1990).

Fibersol-2 has various and unique physical characteristics. Its viscosity is lower than that of a conventional maltodextrin, although both have the same DE value. A solution of Fibersol-2 is very clear and stable, and does not become cloudy or show signs of any precipitation (retrogradation) when kept for long periods of time. It also has very good anti-acid

properties (in contrast to sugars), and can be cooked and sterilised at high temperature in food applications due to its stability in heat processes.

44.3 Safety of Fibersol-2

Neither acute toxicity (LD_{50} in rats >20 g/kg) nor mutagenicity have been found with Fibersol-2 (Wakabayashi *et al.* 1992a). According to a long-term administration study in rats, Fibersol-2 scarcely affects animal growth, weight of internal organs or any blood biochemical parameters. Indigestible saccharides, including Fibersol-2, have been shown to cause some diarrhoea when taken in excessive quantities, although we have the dose required for this (ED_{50}) to be >1.0 g/kg body weight. It is considered that the higher ED_{50} value of Fibersol-2 compared with other indigestible saccharides (e.g. sugar alcohols) is due to its higher molecular weight and lower osmotic pressure (Satouchi *et al.* 1993).

44.4 Internal movement, energy value and physiological functions of Fibersol-2

Fibersol-2 escapes digestion and absorption in the upper gastrointestinal tract, but when it reaches the large intestine it is partly fermented by bacteria, producing short-chain fatty acids (SCFA). In a previous *in-vitro* study, it was shown that ~10% of Fibersol-2 was degraded by artificial gastric juice, amylase and intestinal mucosa enzymes. Based on the results of a single administration test in rats, the faecal excretion rate of Fibersol-2 was 38% (Wakabayashi *et al.* 1991). Thus, it is estimated that ~90% of the administered Fibersol-2 reaches the large intestine, and half of that is metabolised by intestinal bacteria; the remaining 40% is excreted in the faeces, unused. By contrast, studies on the growth rates of rats fed Fibersol-2 showed that <10% of dextrose is contributing net metabolisable energy. Fibersol-2 has an energy value of 0.5 kcal/g (Tsuji & Gordon 1998).

Based on the above findings, the physiological functions of Fibersol-2 can be separated into those occurring in the upper digestive tract, and those occurring in the lower digestive tract. Fibersol-2 itself affects the absorption rate of carbohydrate in the human body (Fig. 44.2), and this in turn moderates postprandial blood glucose levels. Furthermore, in terms of the indirect effects of Fibersol-2 in humans, the metabolic products of Fibersol-2 (e.g. SCFA) might be expected to improve the intestinal microflora, intestinal regularity and the immune function. SCFA produced in the large intestine are also expected to stimulate bowel movement.

44.4.1 *Moderating effect of postprandial blood glucose levels*

The results of loading tests in rats using various saccharides (Wakabayashi *et al.* 1993, 1995) are shown in Fig. 44.3. The blood glucose levels and insulin secretion of 8-week-old male SD strain rats were monitored for 2 h after oral administration of 1.5 g/kg body weight of sugars, with or without 0.15 g/kg body weight of Fibersol-2. Co-administration of Fibersol-2 led to a lowering of blood glucose levels (to 70% of peak value) found after sucrose or maltose loading. In addition, Fibersol-2 lowered insulin secretion to 63–70% of those of the sucrose-, maltose- and maltodextrin-loaded groups. Thus, the blood glucose-moderating effect of

41 Fructo-oligosaccharides and Other Fructans: Chemistry, Structure and Nutritional effects

Francis R.J. Bornet

41.1 Chemistry, structure and origin

Fructans, such as inulin and fructo-oligosaccharides (FOS) are carbohydrates. They are a group of linear glucosyl $\alpha(1\rightarrow2)(\text{fructosyl})_n\beta(2\rightarrow1)$fructose polymers with a degree of polymerisation (DP) ranging from 3 up to 60 (Fig. 41.1). By definition, if oligosaccharides have a DP lower than 9, they are named fructo-oligosaccharides. The main fructo-oligosaccharides are 1-kestose (GF_1), nystose (GF_2) and fructosylnystose (GF_3) (GF = glucosylfructo-oligosaccharide). The fructans components with a higher DP are named inulin.

41.1.1 *Natural occurrence of fructans*

Fructans occur in a number of plants such as onions, Jerusalem artichokes, asparagus, wheat, rye and garlic (Clevenger *et al.* 1988). Onion has the highest content of FOS, ranging from 25 to 40% (dry matter basis) of which 97% are short-chain FOS (GFn, n <5). Garlic and chicory root have a low FOS content (Table 41.1). In Western countries, the average daily intake of FOS from these natural sources is about 1 g.

Fructans of artichoke globe are mainly composed of long-chain polymers with a DP >40. Chicory, inulin and Jerusalem artichoke have shorter polymers, with a main DP ranging from 20 to 40 (Table 41.2).

Table 41.1 Natural occurrence and distribution of fructo-oligosaccharides (GFn, $n < 9$) in edible plants.

		Proportion of GF (%)				
Substance	% Fructan (DS)	GF_2	GF_3	GF_4	GF_{5-8}	Total
Onion	25–40	61	25	10	3	100
Wheat	1–4	30	13	6	50	100
Chicory	15–20	4	5	5	16	30
Jerusalem artichoke	16–20	DP <9: 50%				
Garlic	25–35	DP <9: 10–20%				

DS, dry substance; DP, degree of polymerisation.

Table 41.2 Natural occurrence and distribution of fructan polymers (inulin; GFn, $n \geq 9$) in edible plants.

Substance	% Fructan (DS)	Degree of polymerisation (%)		
		10–20	20–40	>40
Chicory	15–20	24	45	2
Jerusalem artichoke	16–20	22	20	6
Globe artichoke	2–9	0	13	87

DS, dry substance.

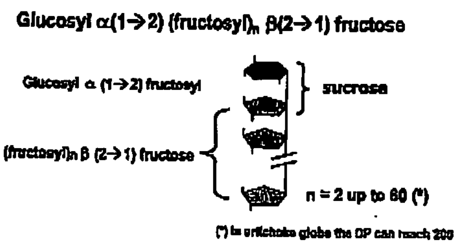

Fig. 41.1 General chemical structure of fructans.

41.1.2 *Structure and composition of commercial FOS ingredients*

FOS are produced on a commercial scale by two different processes, either from sucrose using a food-grade fungal fructosyltransferase (ACTILIGHT®; Béghin Meiji Industries, France), or from inulin by partial hydrolysis using *endo*-inulinase (Orafti, Belgium).

In FOS synthesis from sucrose, the sucrose plays the dual role of fructose donor and fructose acceptor (Fishbein *et al.* 1988). The first reaction on two sucrose molecules leads to kestose and glucose. The action of the fructosyltransferase on kestose produces nystose, and on nystose produces fructosylnystose. The reaction is stopped to optimise the ratio between GF_2/GF_3/GF_4 at 37%/53%/10%. A chromatography step ensures the purification of short-chain FOS (sc-FOS). The composition of commercial product is shown in Fig. 41.2. FOS from sucrose are composed only of glucosyl α(1→2)(fructosyl)$_n$β(2→1)fructose, with n = 1 to 3.

The short-chain FOS mixture has a taste profile similar to that of sucrose, without any cooling effect. The sweetness of the purified short-chain FOS mixture is 30% of that of sucrose, while the water-retention capacity is higher than that of sucrose. Being non-reducing sugars, sc-FOS do not lead to Maillard reactions, and they are stable at pH values >3 and temperatures up to 130°C. According to their technological characteristics, sc-FOS may be used as ingredients in biscuits and cakes, breakfast cereals and cereal-filled bars, ices and desserts, dairy products, yoghurt and milk.

Chicory inulin is hydrolysed by *endo*-inulinase, producing a mixture of glucosyl α(1→2)(fructosyl)$_n$β(2→1)fructose with n = 1 to 6, and fructosyl β(2→1)(fructosyl)$_n$-

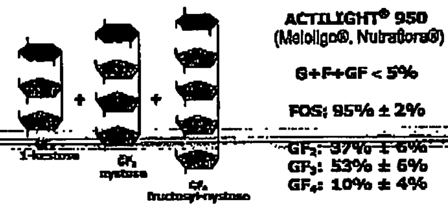

Fig. 41.2 Composition of commercial fructo-oligosaccharides ingredients from a sucrose source.

β(2→1)fructose with n = 2 to 7 (Fig. 41.3). A chromatography step ensures the purification of FOS. The composition of the commercial product is given in Fig. 41.4.

41.1.3 *Structure and composition of commercial inulins*

The commercial inulins are obtained by hot-water extraction from chicory roots. The composition of inulin extracts are variable: it is a function of many factors such as the source from which it was extracted, the climate and the growing conditions, the harvesting time and storage conditions. Figure 41.5 illustrates the average composition of a commercial inulin extract (Raftiline® ST, Orafti, Belgium). Different commercial products are available, one of which has a low FOS content (< 2%, Raftiline® HP; Orafti).

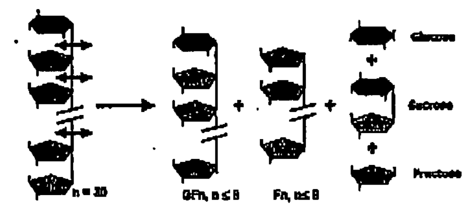

Fig. 41.3 Action of the *endo*-inulinase on chicory inulin.

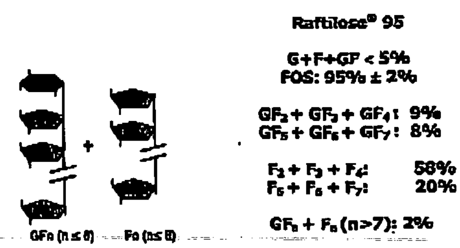

Fig. 41.4 Composition of commercial fructo-oligosaccharides ingredients from a chicory inulin source.

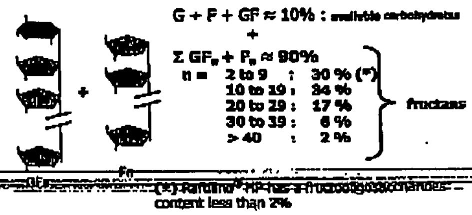

Fig. 41.5 Average composition of commercial inulin from chicory.

41.2 Methods to measure sc-FOS in food products

A recent survey conducted by Lee and Prosky (1995) concerning the definition of dietary fibre supports the view that the definition should be revised to include oligosaccharides that are resistant to hydrolysis by the alimentary tract, as are the sc-FOS.

The AOAC dietary fibre analytical method involves three enzymatic digestion steps with α-amylase, protease and amyloglucosidase. These enzymatic treatments do not modify the sc-FOS structures. However, the AOAC method does not measure sc-FOS because of their ethanol solubility. Ouarné *et al.* (1997) have developed a specific and reliable analytical method to measure sc-FOS in food products. The method involves an invertase hydrolysis step, followed by detection of sugars using a Dionex ion chromatograph. The minimal amount of quantifiable sc-FOS is 0.75 g per 100 g of food product.

Other methods for the measurement of sc-FOS are AOAC Method 997.08 (Hoebregs 1997) and AOAC Method 999.03 (McCleary *et al.* 2000). Both of these methods use inulinase enzymes to hydrolyse FOS to fructose and glucose. In the latter procedure, sucrose is selectively removed with a pure sucrase enzyme.

41.3 Nutritional aspects

The FOS have aroused interest during the past decade, mostly because of their nutritional properties. Fructans, to a large extent, escape digestion in the human upper intestine and reach the colon where they are totally fermented, mostly to lactate, short-chain fatty acids (SCFAs; acetate, propionate and butyrate), H_2 and CO_2. The most important property of FOS is their ability to stimulate bifidobacterial growth specifically while suppressing the growth of some other species in the colon, such as *Clostridium perfringens*. The demonstration of the potential health benefits of FOS constitutes an active field of research in human nutrition.

41.3.1 *Digestive fate of sc-FOS*

Numerous *in-vitro* studies have been conducted in animal models and in humans, showing the indigestibility of sc-FOS in the small intestine. Kestose (GF_2) and nystose (GF_3) are not significantly hydrolysed by pancreatic homogenate (Oku *et al.* 1984), purified sucrase-isomaltase complex (Oku *et al.* 1984), nor by small intestinal mucosa homogenate from either animals (Oku *et al.* 1984; Tsuji *et al.* 1986) or human (Molis *et al.* 1996). Long-term

ingestion of sc-FOS did not cause induction or suppression of the hydrolysing enzymes in the rat small intestine (Oku *et al.* 1984). In addition, sc-FOS did not influence the transmural potential difference of everted sacs prepared from the jejunum (Tokunaga *et al.* 1986). When injected intravenously into rats, sc-FOS are rapidly excreted in the urine, without degradation, suggesting that they are not used as an energy source in the body (Oku *et al.* 1984).

The percentage of ingested sc-FOS reaching the colon has been measured in six healthy volunteers using the intubation and the slow marker method (Molis *et al.* 1996). Some 90% of the ingested sc-FOS have been recovered at the end of the ileum. Moreover, the percentages of the constitutive sc-FOS (GF_2, GF_3 and GF_4) remain identical to those of ingested sc-FOS, showing that most unabsorbed sc-FOS were in an intact unhydrolysed form.

Utilisation of sc-FOS was studied *in vivo* in man using a radiorespirometry method, and *in vitro* by incubation with human faeces (Hosoya *et al.* 1988; Tokunaga *et al.* 1989). The studies showed that sc-FOS were fermented by intestinal microorganisms, mainly to SCFAs and CO_2, and that the SCFAs are absorbed by the colon and further converted to CO_2 in the body. Compared with other fermentable products, such as cellulose, pectin or lactulose, the fermentation of FOS produces higher percentages of propionic and butyric acid (Bornet *et al.* 1994; Luo *et al.*, 1996). SCFAs are absorbed in the colon, and are in part metabolised within the colon; the remainder is metabolised in the liver and peripheral tissues (Bornet *et al.* 1994).

41.3.2 *Caloric values of fructans*

Sc-FOS not hydrolysed in the upper gastrointestinal tract are completely fermented in the colon, such that none is found in the stools (Molis *et al.* 1996). The colonic fermentation of carbohydrates is responsible for SCFAs, lactic acid and gas production, bacterial maintenance and growth, and heat dissipation (Macfarlane & Cummings 1991), which results in a loss of energy for the host estimated to be equal to 50% of the energy content of carbohydrate (Van Es 1987; Hobbs 1988; Beaugerie *et al.* 1990).

Molis *et al.* 1996, using the ileal intubation method in healthy subjects, estimated that the caloric value of sc-FOS was 9.5 kJ/g, a value somewhat higher than the 6.3 kJ/g reported by Hosoya *et al.* (1988). Those authors used a radiorespirometry method in healthy subjects ingesting [U-^{14}C] sc-FOS, and also measured gas and SCFA production from labelled sc-FOS in anaerobic incubation with faeces. They postulated that SCFAs were completely absorbed in the large intestine, but they used a very low mean energy content for SCFAs (10.0 kJ/g) to calculate the energy value of sc-FOS. The heat produced by combustion of acetic, propionic and butyric acids is 14.6, 20.7 and 25.0 kJ/g, respectively (Blaxter 1989). Accordingly, the metabolisable energy from acetic, propionic and butyric acids is 10.9–12.6, 15.5–17.6 and 18.8–21.3 kJ/g, respectively. According to these figures, the energy value of FOS should range between 8.4 and 9.2 kJ/g, a value close to that found by Molis *et al.* (1996). Sc-FOS in healthy humans are only slightly digested in the small intestine and are fermented in the colon, resulting in reduced energy production (about one-half that of sucrose). The caloric value of inulin is claimed to be 1 kcal/g.

41.3.3 *Effects of sc-FOS on glucose and lipid metabolism*

The glycaemic, insulinaemic and fructosaemic responses to sc-FOS have been studied in

MSDS Number: **C0384** * * * * * *Effective Date:* ***05/14/03*** * * * * * *Supercedes:* ***11/02/01***

CALCIUM GLUCONATE

1. Product Identification

Synonyms: D-Gluconic acid, calcium salt (2:1); Glucobiogen; Calciofon.
CAS No.: 299-28-5
Molecular Weight: 430.38
Chemical Formula: [CH2OH(CHOH)4COO]2Ca
Product Codes: 1272

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardo
Calcium Gluconate	299-28-5	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
Not expected to be a health hazard.
Ingestion:
Large oral doses may cause irritation to the gastrointestinal tract.
Skin Contact:
Not expected to be a health hazard from skin exposure.
Eye Contact:
Not expected to be a health hazard.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

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4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Wash thoroughly with running water. Get medical advice if irritation develops.

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5. Fire Fighting Measures

Fire:
As with most organic solids, fire is possible at elevated temperatures or by contact with an ignition source. Minimum dust cloud ignition temperature: 550C (1022F)
Explosion:
Essentially no hazard as dust (Vendor/Bureau of Mines Relative Rating Scale). No explosion detected up to 200 g/cu. ft. air.
Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal.

Vacuuming or wet sweeping may be used to avoid dust dispersal. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
In general, dilution ventilation is a satisfactory health hazard control for this substance. However, if conditions of use create discomfort to the worker, a local exhaust system should be considered.
Personal Respirators (NIOSH Approved):
For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White, crystalline powder.
Odor:
Odorless.
Solubility:
3 g in 100 g of water
Density:
No information found.
pH:
6-7
% Volatiles by volume @ 21C (70F):
0
Boiling Point:

Not applicable.
Melting Point:
ca. 120C (ca. 248F) Loses water with some decomposition
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibilities.

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11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

--------\Cancer Lists\--

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Calcium Gluconate (299-28-5)	No	No	None

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12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of

this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------------------------------

Ingredient	TSCA	EC	Japan	Australia
Calcium Gluconate (299-28-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------------------------------

Ingredient	Korea	--Canada-- DSL	--Canada-- NDSL	Phil.
Calcium Gluconate (299-28-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	-SARA 302- TPQ	------SARA 313------ List	------SARA 313------ Chemical Catg.
Calcium Gluconate (299-28-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Calcium Gluconate (299-28-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: No Chronic: No Fire: Yes Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 0 Flammability: 1 Reactivity: 0
Label Hazard Warning:

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

Label Precautions:
None.

Label First Aid:
Not applicable.

Product Use:
Laboratory Reagent.

Revision Information:
MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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